FCC PART 101

TEST AND MEASUREMENT REPORT

For

Peninsula Engineering Solutions, Inc.

39 Grand Canyon Lane,

San Ramon, CA 94582, USA

FCC ID: QFT-HR-11500
Model: HR-11500

Report Type: Original Report	**Product Type:** Microwave Linear Heterodyne Radio Repeater

Test Engineer: Lionel Lara

Report Number: R1301071-101

Report Date: 2013-02-26

Reviewed By: Quinn Jiang, Test Engineer

Bay Area Compliance Laboratories Corp.
1274 Anvilwood Avenue,
Sunnyvale, CA 94085, U.S.A.
Tel: (408) 732-9162
Fax: (408) 732 9164
www.baclcorp.com

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DOCUMENT REVISION HISTORY

Revision Number	Report Number	Description of Revision	Date of Revision
0	R1301071-101	Original Report	2013-02-26

1. General Information

1.1 Product Description for Equipment under Test (EUT)

The report has been prepared on behalf of *Peninsula Engineering Solutions,Inc.* and their product FCC ID: QFT-HR-11500, Model: HR-11500, or the EUT as referred to in the rest of this report. The EUT is a microwave linear heterodyne radio repeater working on 10700-11700 MHz. The EUT has 4 modulations: 16QAM, 32QAM, 64QAM, and 128QAM.

1.2 Mechanical Description EUT

The EUT measures approximately 54.8cm (L) x 45.7cm (W) x 62.3cm (H) and weighs 33 kg.

The test data gathered are from production sample. Serial numbers: 12121502, 12121501, and 12121503 provided by the manufacturer.

1.3 Objective

This type approval report is prepared on behalf of *Peninsula Engineering Solutions, Inc* in accordance with Part 101 of the Federal Communication Commissions rules.

The objective is to determine compliance with FCC Part 101 rules.

1.4 Related Submittal(s)/Grant(s)

None.

1.5 Test Methodology

All tests and measurements indicated in this document were performed in accordance with the Code of federal Regulations Title 47 Part 2, Sub-part J as well as the following individual parts:

Part 101 – Fixed Microwave Services

Applicable Standards:TIA603-C and ANSI 63.4-2003, American National Standard for Method of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the range of 9 kHz to 40 GHz.

1.6 Measurement Uncertainty

All measurements involve certain levels of uncertainties, especially in the field of EMC. The factors contributing to uncertainties are spectrum analyzer, cable loss, antenna factor calibration, antenna directivity, antenna factor variation with height, antenna phase center variation, antenna factor frequency interpolation, measurement distance variation, site imperfections, mismatch (average), and system repeatability.

Based on NIS 81, The Treatment of Uncertainty in EMC Measurements, the values ranging from $\pm$2.0 dB for Conducted Emissions tests and $\pm$4.0 dB for Radiated Emissions tests are the most accurate estimates pertaining to uncertainty of EMC measurements at BACL Corp.

1.7 Test Facility

The test site used by BACL Corp. to collect radiated and conducted emissions measurement data is located at its facility in Sunnyvale, California, USA.

The test site at BACL Corp. has been fully described in reports submitted to the Federal Communication Commission (FCC) and Voluntary Control Council for Interference (VCCI). The details of these reports have been found to be in compliance with the requirements of Section 2.948 of the FCC Rules on February 11 and December 10, 1997, and Article 8 of the VCCI regulations on December 25, 1997. The test site also complies with the test methods and procedures set forth in CISPR 22:2008 §10.4 for measurements below 1 GHz and §10.6 for measurements above 1 GHz as well as ANSI C63.4-2003, ANSI C63.4-2009, TIA/EIA-603 & CISPR 24:2010.

The Federal Communications Commission and Voluntary Control Council for Interference have the reports on file and they are listed under FCC registration number: 90464 and VCCI Registration No.: A-0027. The test site has been approved by the FCC and VCCI for public use and is listed in the FCC Public Access Link (PAL) database.

Additionally, BACL Corp. is an American Association for laboratory Accreditation (A2LA) accredited laboratory (Lab Code 3297-02). The current scope of accreditations can be found at

http://www.a2la.org/scopepdf/3297-02.pdf?CFID=1132286&CFTOKEN=e42a3240dac3f6ba-6DE17DCB-1851-9E57-477422F667031258&jsessionid=8430d44f1f47cf2996124343c704b367816b

2 EUT Test Configuration

2.1 Justification

The EUT was configured for testing according to TIA/EIA-603-C.

The EUT was tested in the normal (native) operating mode to represent *worst*-case results during the final qualification test.

2.2 EUT Exercise Software

N/A

2.3 Equipment Modifications

No modifications were made to the EUT.

2.4 Local Support Equipment

Manufacturer	Description	Model No.	Serial No.
Agilent	Signal Generator	E4438C	MY45091309

2.5 Internal Configuration

Manufacturer	Description	Model No.	Serial No.
Peninsula Engineering	Antenna Coupling Unit	049-0390-11	-
Aldetec, Inc	Heterodune RF Module	ALS04820	121115003, 121219009, 121221001
Peninsula Engineering	Reference Oscillator Unit	090-0410-01	12121101, 12121301, 12121001
Peninsula Engineering	Reference Oscillator PCB	087-0460-01	-
Peninsula Engineering	DC Distribution PCB	087-1242-02	-
Peninsula Engineering	Power Supply Assy	090-0286-07	-
Vicor	DC-DC Converter Module	VI-MC-N1-1Q-CC	-
Asentria	Alarm Control Unit	S-420-0 PES01	S42001001218, S42001001229,S42001001250

2.6 Power Supply

Manufacturer	Description	Model	Serial Number
BK Precision	DC Power Supply	1740	26502000233

2.7 Interface Ports and Cabling

Cable Description	Length (m)	From	To
Power Supply Cable	>1.0	Power Supply	EUT
RF cable	<1.0	Signal Generator	EUT
RF cable	<1.0	EUT Output	PSA

3 Summary of Test Results

FCC Rules	Description of Test	Result
§2.1091	RF Exposure Information	Compliant
§2.1046, §101.113	Transmitter Power	Compliant
§2.1049, §101.109	Occupied Bandwidth	Compliant
§2.1051, §101.111	Conducted Out of Band Emissions	Compliant
§2.1055, §101.107	Frequency Tolerance	Compliant
§2.1053, §101.111	Radiated Out of Band Emissions	Compliant
§101.111	Spectrum Emission Mask	Compliant

4 FCC §2.1091 - RF Exposure Information

4.1 Applicable Standards

FCC §2.1091, (a) Requirements of this section are a consequence of Commission responsibilities under the National Environmental Policy Act to evaluate the environmental significance of its actions. See subpart I of part 1 of this chapter, in particular §1.1307(b).

According to §1.1310 and §2.1091 RF exposure is calculated.

Limits for Exposure

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm^2)	Averaging Time (minutes)
(A) Limits for Occupational/Controlled Exposures				
0.3-3.0	614	1.63	*(100)	6
3.0-30	1842/f	4.89/f	*($900/f^2$)	6
30-300	61.4	0.163	1.0	6
300-1500	/	/	f/300	6
1500-100,000	/	/	5	6
(B) Limits for General Population/Uncontrolled Exposure				
0.3-1.34	614	1.63	*(100)	30
1.34-30	842/f	2.19/f	*($180/f^2$)	30
30-300	27.5	0.073	0.2	30
300-1500	/	/	f/1500	30
1500-100,000	/	/	1	30

f = frequency in MHz
** = Plane-wave equivalent power density*

Note 1 to Table 1: Occupational/controlled limits apply in situations in which persons are exposed as a consequence of their employment provided those persons are fully aware of the potential for exposure and can exercise control over their exposure. Limits for occupational/controlled exposure also apply in situations when an individual is transient through a location where occupational/controlled limits apply provided he or she is made aware of the potential for exposure.

Note 2 to Table 1: General population/uncontrolled exposures apply in situations in which the general public may be exposed, or in which persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or can not exercise control over their exposure.

Antenna

The manufacturer does not specify an antenna. This device has provisions for operation in a fixed location.

MPE Prediction

Predication of MPE limit at a given distance, Equation from OET Bulletin 65, Edition 97-01

$$S = PG/4\pi R^2$$

Where: S = power density
P = power input to antenna
G = power gain of the antenna in the direction of interest relative to an isotropic radiator
R = distance to the center of radiation of the antenna

Maximum peak output power at antenna input terminal (dBm):	32.02
Maximum peak output power at antenna input terminal (mW):	1592.21
Prediction distance (cm):	1700
Prediction frequency (MHz):	10755
Maximum Antenna Gain, typical (dBi):	50.5
Maximum Antenna Gain (numeric):	112201.8
Power density of prediction frequency at 1700 cm (mW/cm^2):	4.919
MPE limit for controlled exposure at prediction frequency (mW/cm^2):	5.0

Conclusion

The device complies with the MPE requirements by providing a safe separation distance of at least 1700 cm between the antenna with maximum 50.5 dBi gain, including any radiating structure, and any persons when normally operated.

5 FCC §2.1046 & §101.113 – Transmitter Output Power

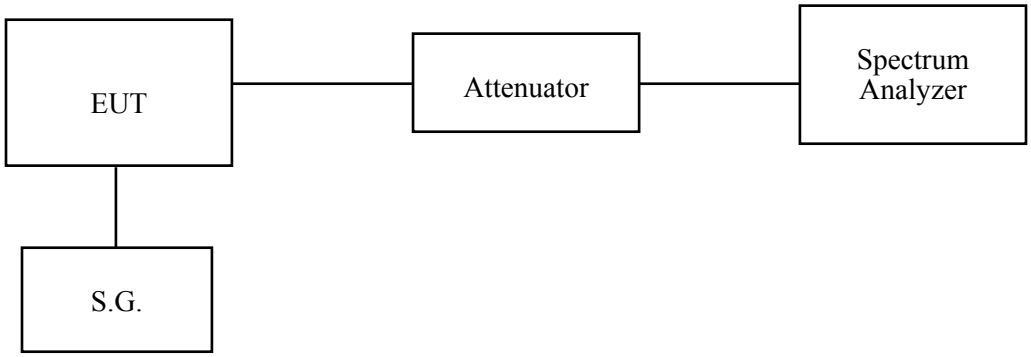
5.1 Applicable Standard

According to FCC §101.113, (a) On any authorized frequency, the average power delivered to an antenna in this service must be the minimum amount of power necessary to carry out the communications desired. Application of this principle includes, but is not to be limited to, requiring a licensee who replaces one or more of its antennas with larger antennas to reduce its antenna input power by an amount appropriate to compensate for the increased primary lobe gain of the replacement antenna(s). In no event shall the average equivalent isotropically radiated power (EIRP), as referenced to an isotropic radiator, exceed the values specified below. In cases of harmful interference, the Commission may, after notice and opportunity for hearing, order a change in the effective radiated power of this station. Further, the output power of a transmitter on any authorized frequency in this service may not exceed the following:

Frequency Band (MHz)	Maximum allowable EIRP[1,2]		Frequency Band (MHz)	Maximum allowable EIRP[1,2]	
	Fixed[1,2](dBW)	Mobile (dBW)		Fixed[1,2](dBW)	Mobile (dBW)
928.0–929.0(2)	+17		10,700–11,700	+55	
932.0–932.5(2)	+17		12,200–12,700[11]	+50	
932.5–935.0	+40		12,700–13,200[4]	+50	
941.0–941.5(2)	+30	+14	13,200–13,250[4]	+55	
941.5–944.0	+40		14,200–14,400[12]	+45	
952.0–960.0(2)	+40	+14	17,700–18,600	+55	
1,850–1,990	+45		18,600–18,800[6]	+35	
2,110–2,150	+45		18,800–19,700	[5]+55	
2,150–2,180[3]	+45		21,200–23,600[10]	+55	
2,180–2,200	+45		24,250–25,250	[5]+55	
2,450–2,500	+45		27,500–28,350[9]	+55	
2,500–2,686			29,100–29,250	([7])	
2,686–2,690	+45		31,000 to 31,075[8,9]	30 dBW/MHz	30 dBW/MHz
3,700–4,200	+55		31,075 to 31,225[8,9]	30 dBW/MHz	30 dBW/MHz
5,925–6,425	+55		31,225 to 31,300[8,9]	30 dBW/MHz	30 dBW/MHz
6,425–6,525		+35	38,600–40,000	+55	
6,525–6,875	+55		71,000–76,000[13]	+55	+55
6,875–7,125	+55		81,000–86,000[13]	+55	+55
10,550 to 10,600[5]	+55		92,000–95,000	+55	+55
10,600 to 10,680[5]	+40				

5.2 Test Procedure

The RF output of the transmitter was connected to the input of the spectrum analyzer through sufficient attenuation.



5.3 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Cycle
Agilent	Spectrum Analyzer	E4446A	US44300386	2012-09-29	1 year
Agilent	Signal Generator	E4438C	MY45091309	2012-05-03	1 year

Statement of Traceability: **BACL Corp.** attests that all calibrations have been performed according to A2LA requirements, traceable to the NIST.

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5.4 Test Environmental Conditions

Temperature:	21 °C
Relative Humidity:	48 %
ATM Pressure:	101.6kPa

The testing was performed by Lionel Lara on 2013-01-17 in RF site.

5.5 Test Results

Channel	Modulation	Frequency (MHz)	Conducted Output Power (dBm)	Conducted Output Power (dBW)	Max Ant. Gain (dBi)	EIRP (dBW)	Limit (dBW)
Low	16QAM	10755	32.02	2.02	50.5	52.52	55
	32QAM	10755	29.93	-0.07	50.5	50.43	55
	64QAM	10755	27.68	-2.32	50.5	48.18	55
	128QAM	10755	25.69	-4.31	50.5	46.19	55
Middle	16QAM	11245	31.24	1.24	50.5	51.74	55
	32QAM	11245	29.37	-0.63	50.5	49.87	55
	64QAM	11245	27.18	-2.82	50.5	47.68	55
	128QAM	11245	25.09	-4.91	50.5	45.59	55
High	16QAM	11685	31.27	1.27	50.5	51.77	55
	32QAM	11685	29.21	-0.79	50.5	49.71	55
	64QAM	11685	27.32	-2.68	50.5	47.82	55
	128QAM	11685	25.23	-4.77	50.5	45.73	55

6 FCC §2.1051 & §101.111 - Conducted Out of Band Emissions

6.1 Applicable Standard

FCC §2.1051and §101.111

(a) The mean power of emissions must be attenuated below the mean output power of the transmitter in accordance with the following schedule:

(2) When using transmissions employing digital modulation techniques (see §101.141(b)) in situations not covered in this section:

(i) For operating frequencies below 15 GHz, in any 4 KHz band, the center frequency of which is removed from the assigned frequency by more than 50 percent up to and including 250 percent of the authorized bandwidth: As specified by the following equation but in no event less than 50 decibels:

A = 35 + 0.8(P −50) + 10 Log10 B. (Attenuation greater than 80 decibels or to an absolute power of less than −13 dBm/1MHz is not required.) where:

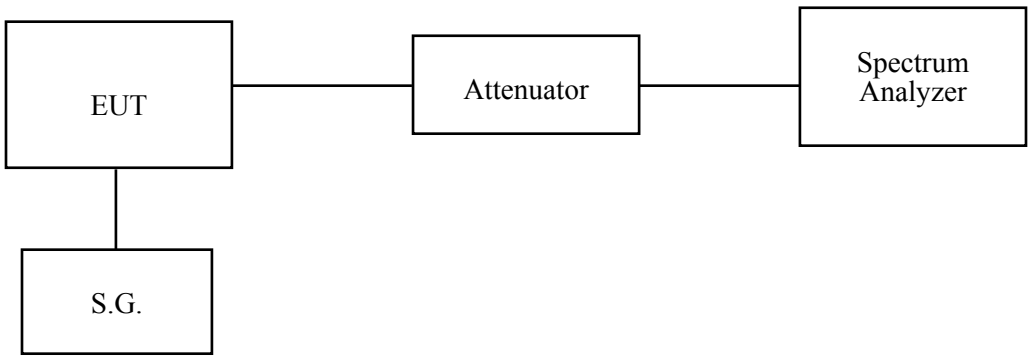
A = Attenuation (in decibels) below the mean output power level.

P = Percent removed from the center frequency of the transmitter bandwidth.

B = Authorized bandwidth in MHz.

6.2 Test Procedure

The RF output of the transceiver was connected to a spectrum analyzer through appropriate attenuation. The resolution bandwidth of the spectrum analyzer was set at 100 kHz. Sufficient scans were taken to show any out of band emissions up to 10th harmonic.



6.3 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Cycle
Agilent	Spectrum Analyzer	E4446A	US44300386	2012-09-29	1 year
Agilent	Signal Generator	E4438C	MY45091309	2012-05-03	1 year

Statement of Traceability: **BACL Corp.** attests that all calibrations have been performed according to A2LA requirements, traceable to the NIST.

6.4 Test Environmental Conditions

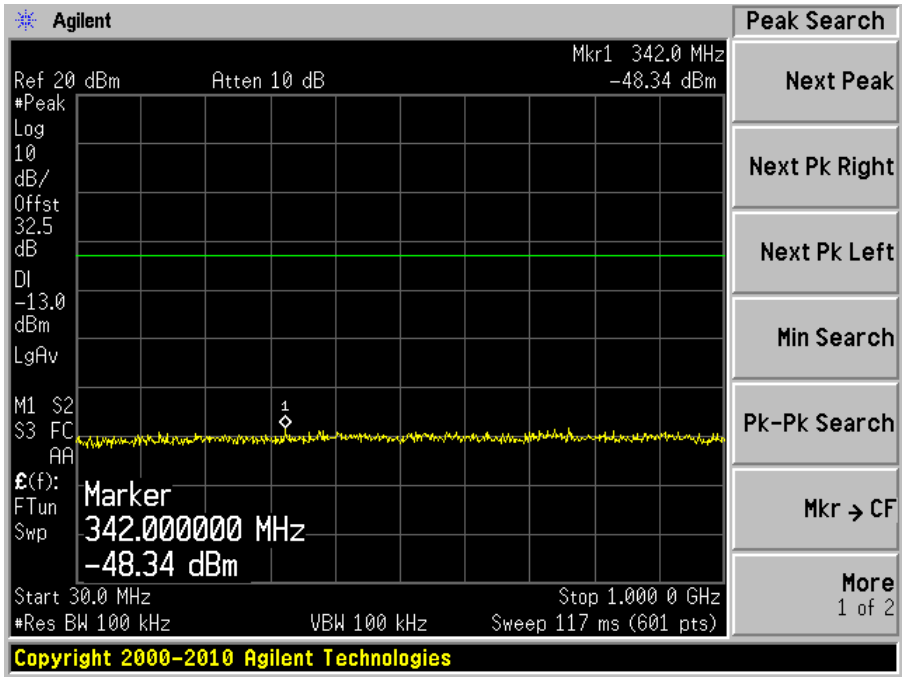
Temperature:	21 °C
Relative Humidity:	48 %
ATM Pressure:	101.6kPa

The testing was performed by Lionel Lara on 2013-01-17 in RF site.

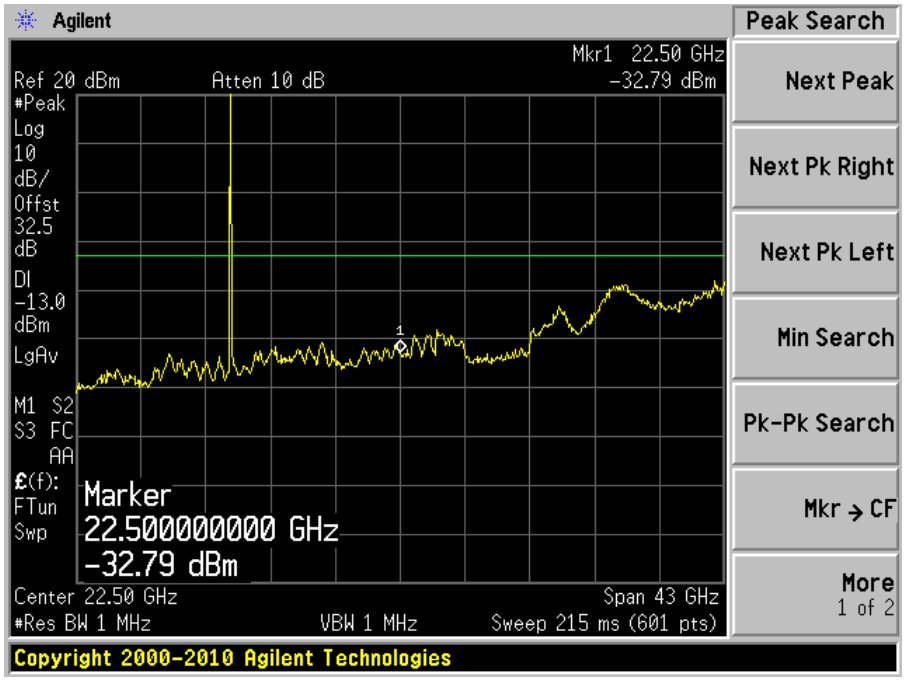
6.5 Test Results

Please refer to the hereinafter plots.

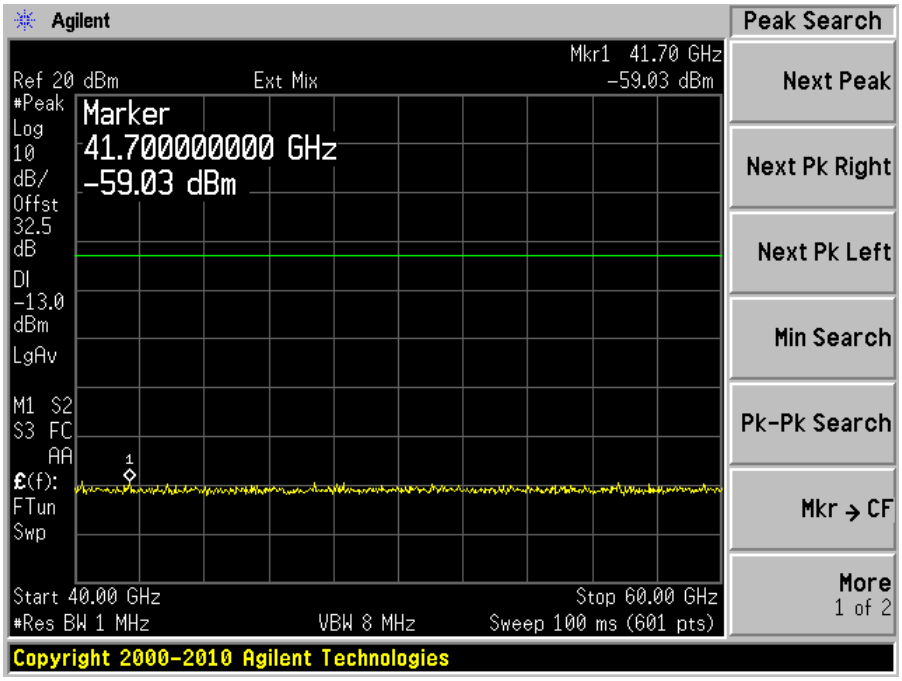
Middle Channel, 11245 MHz



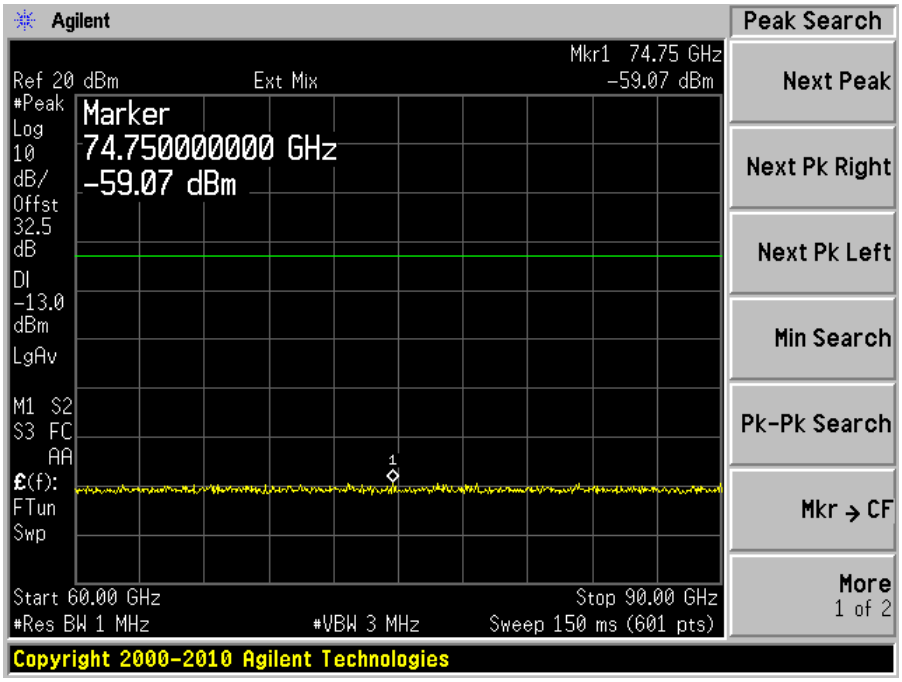
30MHz to 1GHz



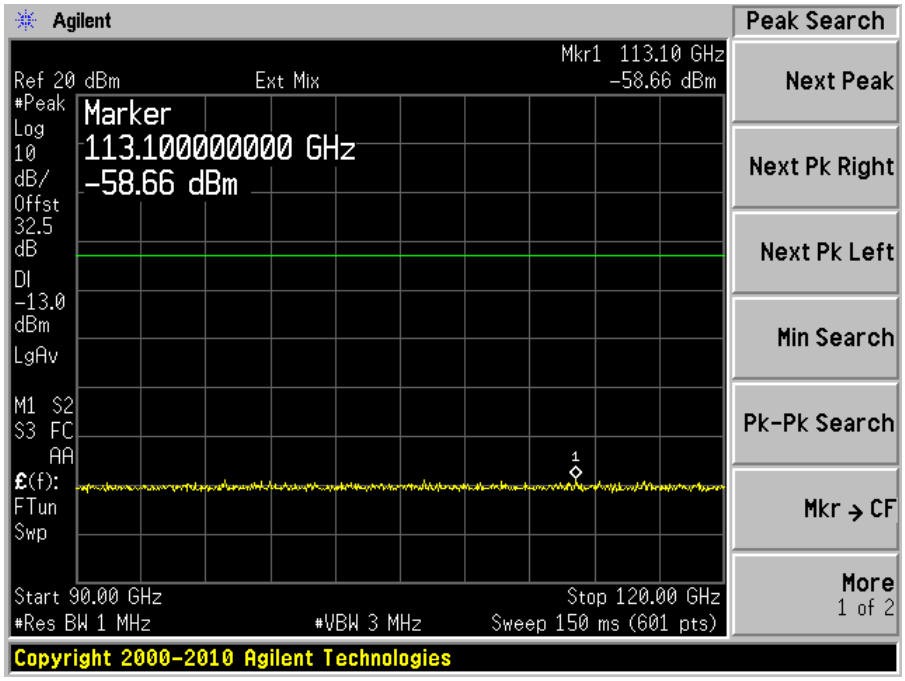
1GHz to 43GHz



40GHz to 60GHz



60GHz to 90GHz



90GHz to 120GHz

7 FCC §2.1055 & §101.107 - Frequency Tolerance

7.1 Applicable Standard

FCC §2.1055 & §101.107

The carrier frequency of each transmitter authorized in these services must be maintained within the following percentage of the reference frequency except as otherwise provided in paragraph (b) of this section or in the applicable subpart of this part (unless otherwise specified in the instrument of station authorization the reference frequency will be deemed to be the assigned frequency):

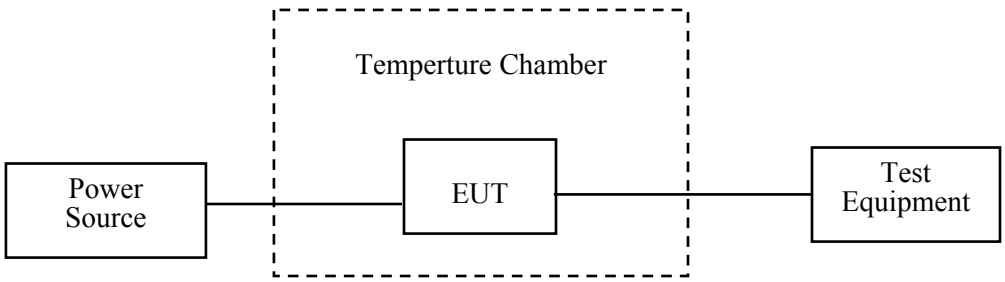
Frequency (MHz)	Frequency Tolerance (percent)	Frequency (MHz)	Frequency Tolerance (percent)
928 to 929[5]	0.0005	12,200 to 13,250[4]	0.005
932 to 932.5	0.00015	14,200 to 14,400	0.03
932.5 to 935	0.00025	17,700 to 18,820[3]	0.003
941 to 941.5	0.00015	18,820 to 18,920[3]	0.001
941.5 to 944	0.00025	928 to 929[5]	0.0005
952 to 960[5]	0.0005	18,920 to 19,700[3]	0.003
1,850 to 1,990	0.002	19,700 to 27,500[4,7]	0.001
2,110 to 2,200	0.001	27,500 to 28,350	0.001
2,450 to 2,500[1]	0.001	29,100 to 29,250	0.001
3,700 to 4,200[1]	0.005	31,000 to 31,300[6]	0.001
5,925 to 6,875[1]	0.005	31,300 to 40,000[4]	0.03
6,875 to 7,125[1]	0.005	71,000 to 76,000[8]	
10,550 to 11,700[1,2]	0.005	81,000 to 86,000[8]	
11,700 to 12,200[1]	0.005	92,000 to 95,000[8]	

7.2 Test Procedure

The RF output of the transmitter was connected to the input of the spectrum analyzer through sufficient attenuation.

The frequency stability of the transmitter is measured by:

a.) **Temperature:** The temperature is varied from - 20 °C to + 60 °C using an environmental chamber.
b.) **Primary Supply Voltage:** The primary supply voltage is varied from battery end point to 110 % of the voltage normally at the input to the device or at the power supply terminals if cables are not normally supplied.



7.3 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Cycle
Agilent	Spectrum Analyzer	E4446A	US44300386	2012-09-29	1 year
Agilent	Signal Generator	E4438C	MY45091309	2012-05-03	1 year
Espec	Humidity Chamber	ESL-4CA	18010	2012-02-10	1 year

Statement of Traceability: **BACL Corp.** attests that all calibrations have been performed according to A2LA requirements, traceable to the NIST.

7.4 Test Environmental Conditions

Temperature:	19-21 °C
Relative Humidity:	45-48 %
ATM Pressure:	101-102kPa

The testing was performed by Lionel Lara on 2013-01-17 to 2013-01-18 in RF site.

7.5 Test Results

Please refer to the following tables.

Test Environment		Channel Frequency (MHz)	Measured Frequency (MHz)	Frequency Error (Hz)	Frequency Error (percent)	Limit (percent)
Supply Voltage (Vdc)	Temperature (°C)					
Frequency Tolerance with Temperature						
54	-20	11245	11244.999881	-119	-1.05825E-06	0.005
	-10	11245	11244.999886	-114	-1.01378E-06	0.005
	0	11245	11244.999887	-113	-1.00489E-06	0.005
	10	11245	11244.999884	-116	-1.03157E-06	0.005
	20	11245	11244.999866	-134	-1.19164E-06	0.005
	30	11245	11244.999869	-131	-1.16496E-06	0.005
	40	11245	11244.999853	-147	-1.30725E-06	0.005
	50	11245	11244.999850	-150	-1.33393E-06	0.005
	60	11245	11244.999807	-193	-1.71632E-06	0.005
Frequency Tolerance with Supply Voltage						
60	20	11245	11244.999859	-141	-1.25389E-06	0.005
42		11245	11244.999866	-134	-1.19164E-06	0.005

8 FCC §2.1053 & §101.111 – Radiated Out of Band Emissions

8.1 Applicable Standard

FCC §2.1053 and §101.111

(a) The mean power of emissions must be attenuated below the mean output power of the transmitter in accordance with the following schedule:

(2) When using transmissions employing digital modulation techniques (see §101.141(b)) in situations not covered in this section:
(i) For operating frequencies below 15 GHz, in any 4 kHz band, the center frequency of which is removed from the assigned frequency by more than 50 percent up to and including 250 percent of the authorized bandwidth: As specified by the following equation but in no event less than 50 decibels:

A = 35 + 0.8(P −50) + 10 Log10 B. (Attenuation greater than 80 decibels or to an absolute power of less than −13 dBm/1MHz is not required.) where:

A = Attenuation (in decibels) below the mean output power level.
P = Percent removed from the center frequency of the transmitter bandwidth.
B = Authorized bandwidth in MHz.

8.2 Test Procedure

The transmitter was placed on styrofoam on the turntable, and it was normal transmitting with 50ohm termination which was also placed on the turntable.

The measurement antenna was placed at a distance of 3 meters from the EUT. During the tests, the antenna height and polarization as well as EUT azimuth were varied in order to identify the maximum level of emissions from the EUT. The test was performed by placing the EUT on 3-orthogonal axis.

The frequency range up to tenth harmonic of the fundamental frequency was investigated.

Remove the EUT and replace it with substitution antenna. A signal generator was connected to the substitution antenna by a non-radiating cable. The absolute levels of the spurious emissions were measured by the substitution.

Spurious emissions in dB = 10 lg (TXpwr in Watts/0.001) – the absolute level

8.3 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Cycle
Rohde & Schwarz	EMI Test Receiver	ESCI 1166.5950K03	100337	2012-03-22	1 year
Agilent	Spectrum Analyzer	E4446A	US44300386	2012-09-29	1 year
Agilent	Signal Generator	E4438C	MY45091309	2012-05-03	1 year
Sunol Science Corp	System Controller	SC99V	122303-1	N/R	N/A
Sunol Science Corp	Combination Antenna	JB3	A020106-2	2012-08-15	1 year
EMCO	Horn antenna	3115	9511-4627	2012-10-17	1 year
Wisewave	Horn antenna	ARH-4223-02	10555-02	2010-06-14	3 years
Wisewave	Horn antenna	ARH-2823-02	10555-01	2012-08-09	1 year
Hewlett Packard	Pre-amplifier	8447D	2944A06639	2012-06-09	1 year
Mini-Circuits	Pre-amplifier	ZVA-183-S	570400946	2012-05-09	1 year

Statement of Traceability: **BACL Corp.** attests that all calibrations have been performed according to A2LA requirements, traceable to the NIST.

8.4 Test Environmental Conditions

Temperature:	19 °C
Relative Humidity:	45 %
ATM Pressure:	101.1kPa

The testing was performed by Lionel Lara on 2013-01-18 in 5 meter chamber 3.

8.5 Test Results

Middle Channel 11245 MHz

Indicated		Turntable Azimuth degrees	Test Antenna		Substituted					Limit (dBm)	Margin (dB)
Freq. (MHz)	Amp. (dBuV)		Height (cm)	Polar (H/V)	Freq. (MHz)	Level (dBm)	Antenna Cord. (dBi)	Cable Loss (dB)	Absolute Level (dBm)		
5460	50.38	153	149	H	5460	-39.33	10.62	2.3	-31.01	-13	-18.01
5460	47.73	190	162	V	5460	-41.98	10.62	2.3	-33.66	-13	-20.66
-[1]	-	-	-	-	-	-	-	-	-	-	-

Note 1: All other spurious emissions were at noise floor level.

9 FCC §2.1049 & §101.109 – Occupied Bandwidth

9.1 Applicable Standard

FCC §2.1049 and §101.109

(c) The maximum bandwidth which will be authorized per frequency assigned is set out in the table that follows. Regardless of the maximum authorized bandwidth specified for each frequency band, the Commission reserves the right to issue a license for less than the maximum bandwidth if it appears that a lesser bandwidth would be sufficient to support an applicant's intended communications.

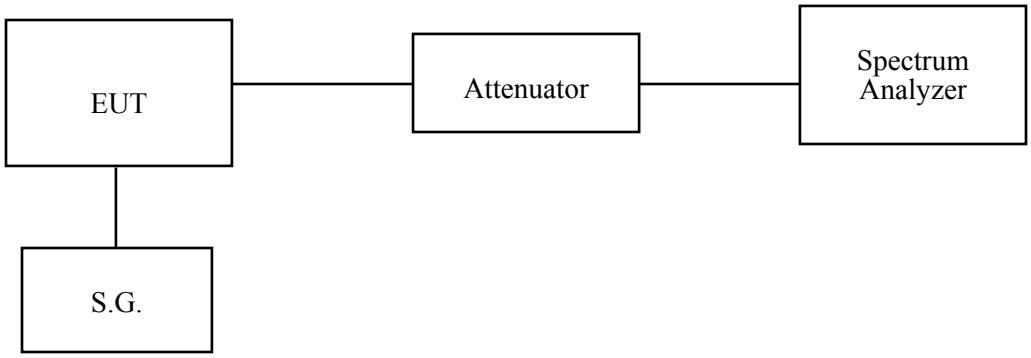
Frequency Band (MHz)	Maximum Authorized Bandwidth	Frequency Band (MHz)	Maximum Authorized Bandwidth
928 to 929	25 kHz[1,5,6]	13,200 to 13,250	25 MHz
932 to 932.5, 941 to 941.5	12.5 kHz[1,5,6]	17,700 to 18,140	220 MHz[1]
932.5 to 935, 941.5 to 944	200 kHz[1]	18,140 to 18,142	2 MHz
952 to 960	200 kHz[1,5,6]	18,142 to 18,580	6 MHz
1,850 to 1,990	10 MHz[1]	18,580 to 18,820	20 MHz[1]
2,110 to 2,130	3.5 MHz	18,820 to 18,920	10 MHz
2,130 to 2,150	800 or 1600 kHz[1]	18,920 to 19,160	20 MHz[1]
2,150 to 2,160	10 MHz	19,160 to 19,260	10 MHz
2,160 to 2,180	3.5 MHz	19,260 to 19,700	220 MHz[1]
2,180 to 2,200	800 or 1600 kHz[1]	21,200 to 23,600	50 MHz[1,4]
2,450 to 2,483.5	625 kHz[2]	24,250 to 25,250	40 MHz[7]
2,483.5 to 2,500	800 kHz	27,500 to 28,350	850 MHz
3,700 to 4,200	20 MHz	29,100 to 29,250	150 MHz
5,925 to 6,425	30 MHz[1]	31,000 to 31,075	75 MHz
6,425 to 6,525	25 MHz	31,075 to 31,225	150 MHz
6,525 to 6,875	30 MHz.[1]	31,225 to 31,300	75 MHz
6,875 to 7,125	25 MHz[1]	38,600 to 40,000	50 MHz[7]
10,550 to 10,680	5 MHz[1]	71,000 to 76,000	5000 MHz
10,700 to 11,700	40 MHz[1]	81,000 to 86,000	5000 MHz
12,200 to 12,700[8]	500 megahertz	92,000 to 95,000	([3])
12,700 to 13,150	50 MHz		

[1]The maximum bandwidth that will be authorized for each particular frequency in this band is detailed in the appropriate frequency table in §101.147. If contiguous channels are aggregated in the 928–928.85/952–952.85/956.25–956.45 MHz, the 928.85–929/959.85–960 MHz, or the 932–932.5/941–941.5 MHz bands, then the bandwidth may exceed that which is listed in the table.

9.2 Test Procedure

The RF output of the transmitter was connected to the spectrum analyzer through sufficient attenuation.

The resolution bandwidth of the spectrum analyzer was set at 30 kHz and the 26 dB & 99% bandwidth was recorded.



9.3 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Cyle
Agilent	Spectrum Analyzer	E4446A	US44300386	2012-09-29	1 year
Agilent	Signal Generator	E4438C	MY45091309	2012-05-03	1 year

Statement of Traceability: **BACL Corp.** attests that all calibrations have been performed according to A2LA requirements, traceable to the NIST.

9.4 Test Environmental Conditions

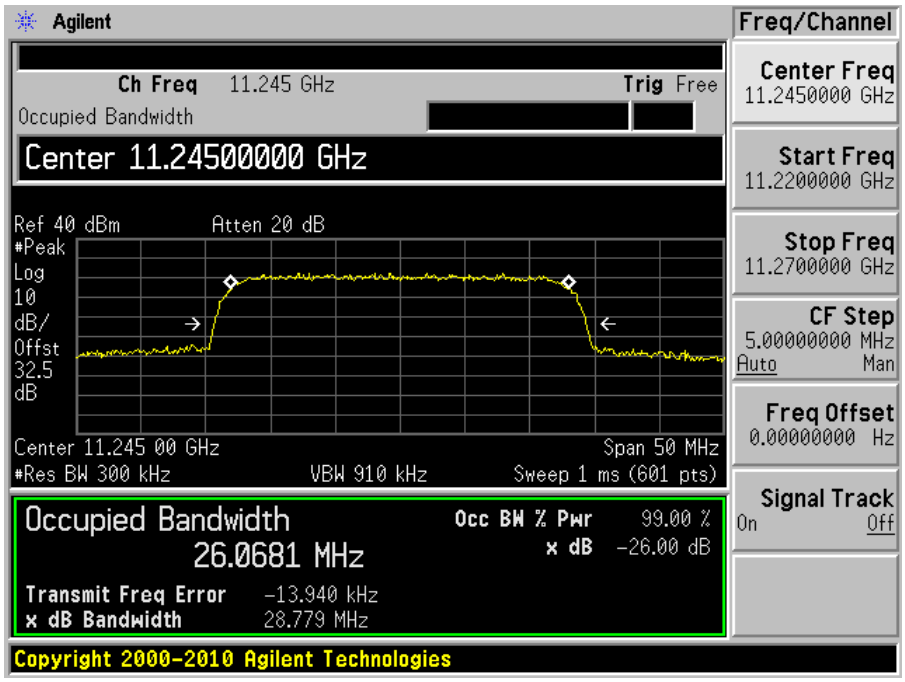
Temperature:	21 °C
Relative Humidity:	48 %
ATM Pressure:	101.6kPa

The testing was performed by Lionel Lara on 2013-01-17 in RF site.

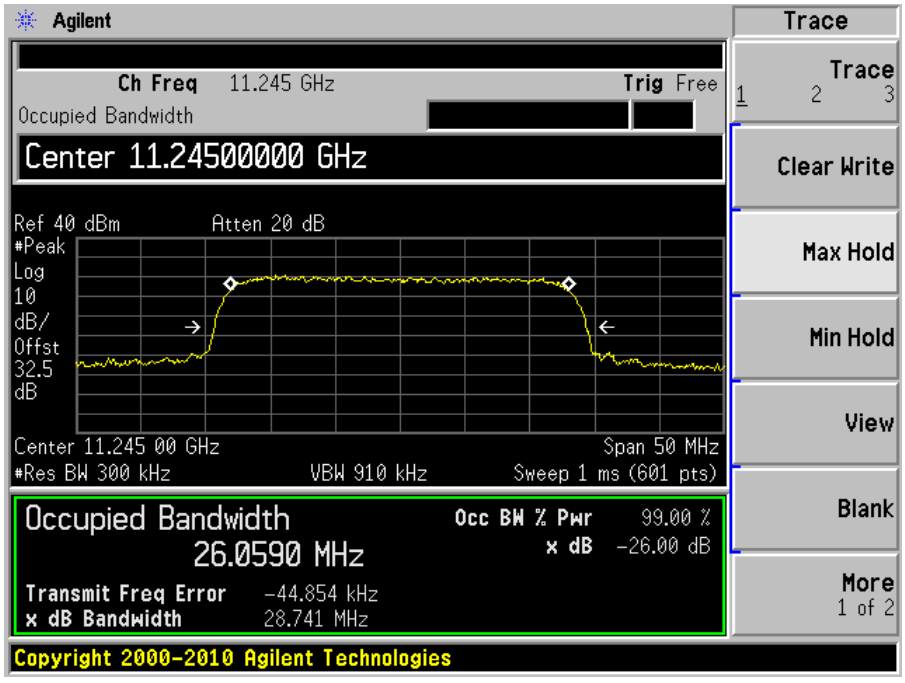
9.5 Test Results

Please refer to the following plots.

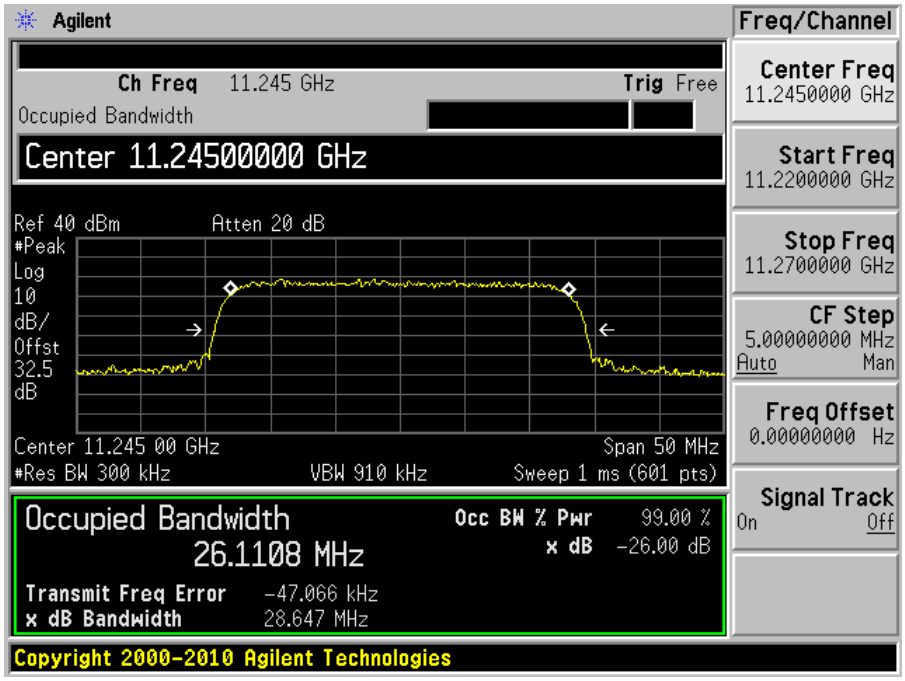
Middle Channel (11245 MHz) – 16QAM



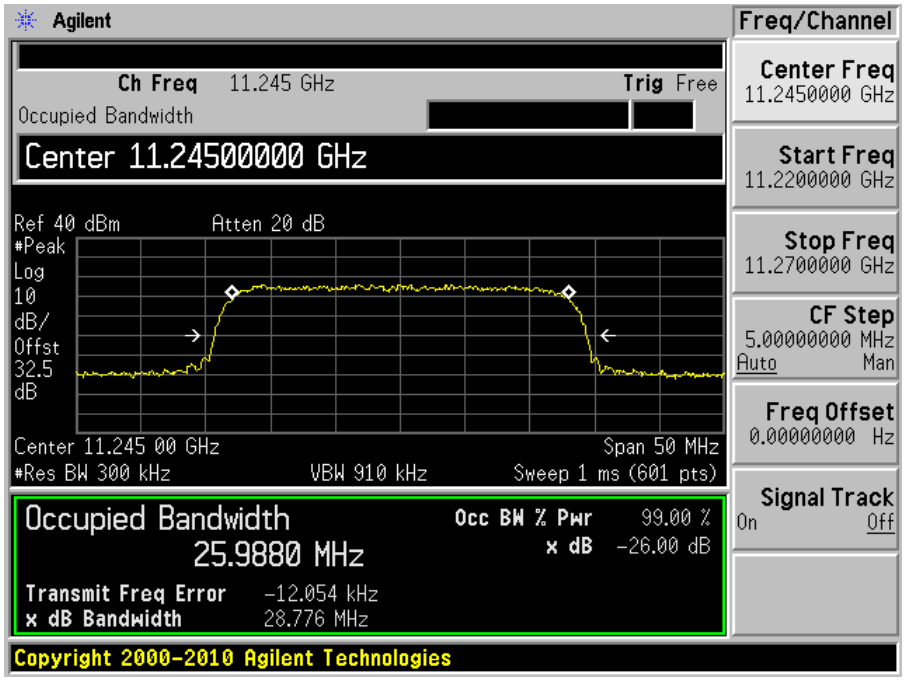
Middle Channel (11245 MHz) – 32QAM



Middle Channel (11245 MHz) – 64QAM



Middle Channel (11245 MHz) – 128QAM



10 FCC §101.111 – Spectrum Emission Mask

10.1 Applicable Standard

(a) The mean power of emissions must be attenuated below the mean output power of the transmitter in accordance with the following schedule:

(2) When using transmissions employing digital modulation techniques (see §101.141(b)) in situations not covered in this section:

(i) For operating frequencies below 15 GHz, in any 4 KHz band, the center frequency of which is removed from the assigned frequency by more than 50 percent up to and including 250 percent of the authorized bandwidth: As specified by the following equation but in no event less than 50 decibels:

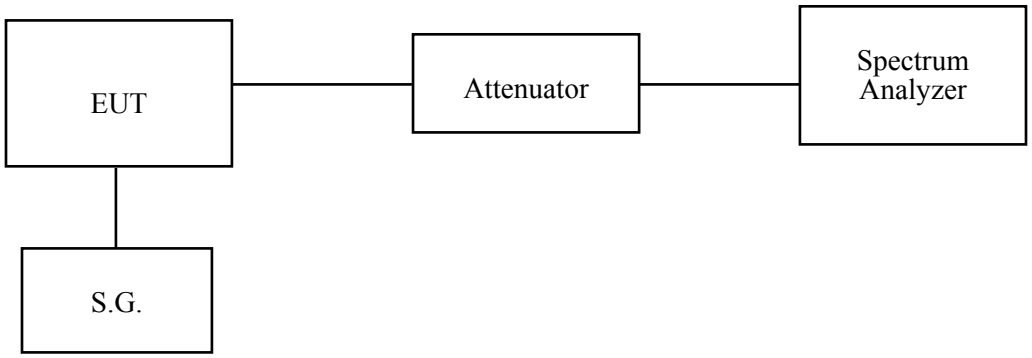
A = 35 + 0.8(P −50) + 10 Log10 B. (Attenuation greater than 80 decibels or to an absolute power of less than −13 dBm/1MHz is not required.) where:

A = Attenuation (in decibels) below the mean output power level.
P = Percent removed from the center frequency of the transmitter bandwidth.
B = Authorized bandwidth in MHz.

10.2 Test Procedure

The RF output of the transmitter was connected to the input of the spectrum analyzer through sufficient attenuation.

The resolution bandwidth of the spectrum analyzer was set at 4 kHz and the spectrum was recorded in the frequency band ±75 MHz from the carrier frequency.



10.3 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration cycle
Agilent	Spectrum Analyzer	E4446A	US44300386	2012-09-29	1 year
Agilent	Signal Generator	E4438C	MY45091309	2012-05-03	1 year

Statement of Traceability: **BACL Corp.** attests that all calibrations have been performed according to A2LA requirements, traceable to the NIST.

10.4 Test Environmental Conditions

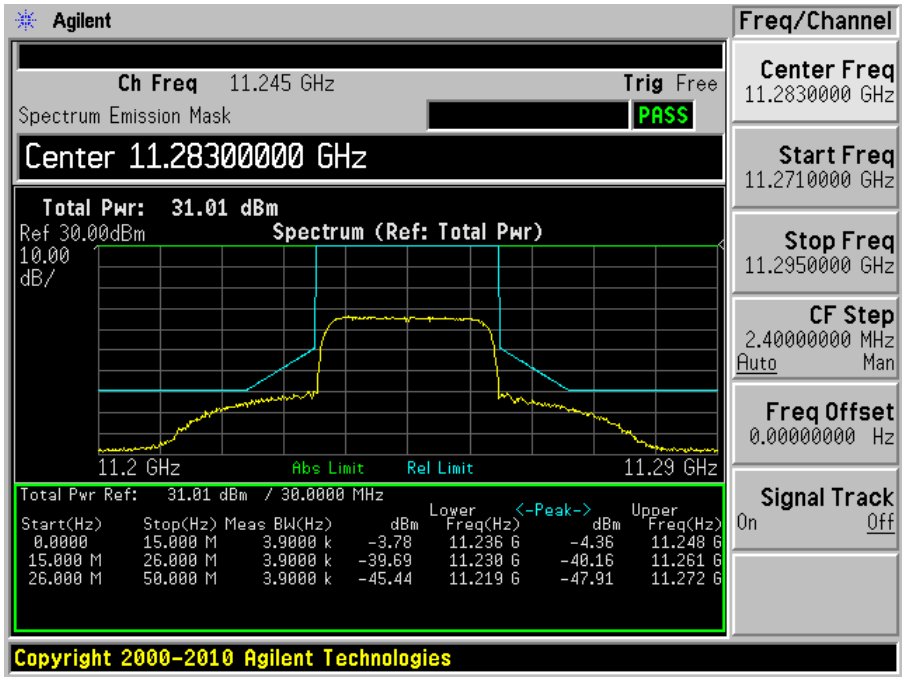
Temperature:	21 °C
Relative Humidity:	48 %
ATM Pressure:	101.6kPa

The testing was performed by Lionel Lara on 2013-01-17 in RF site.

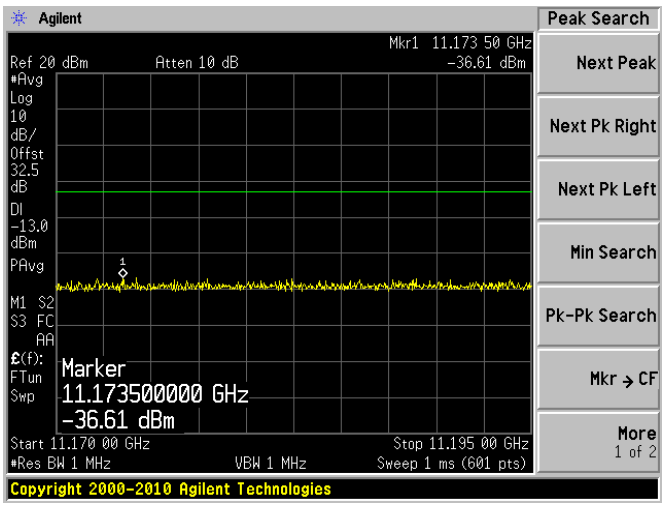
10.5 Test Results

Please refer to the following plots.

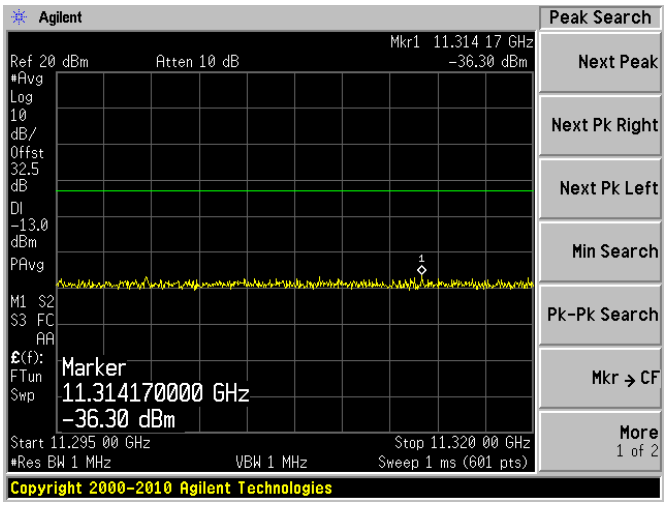
Middle Channel (11245 MHz) – 16QAM



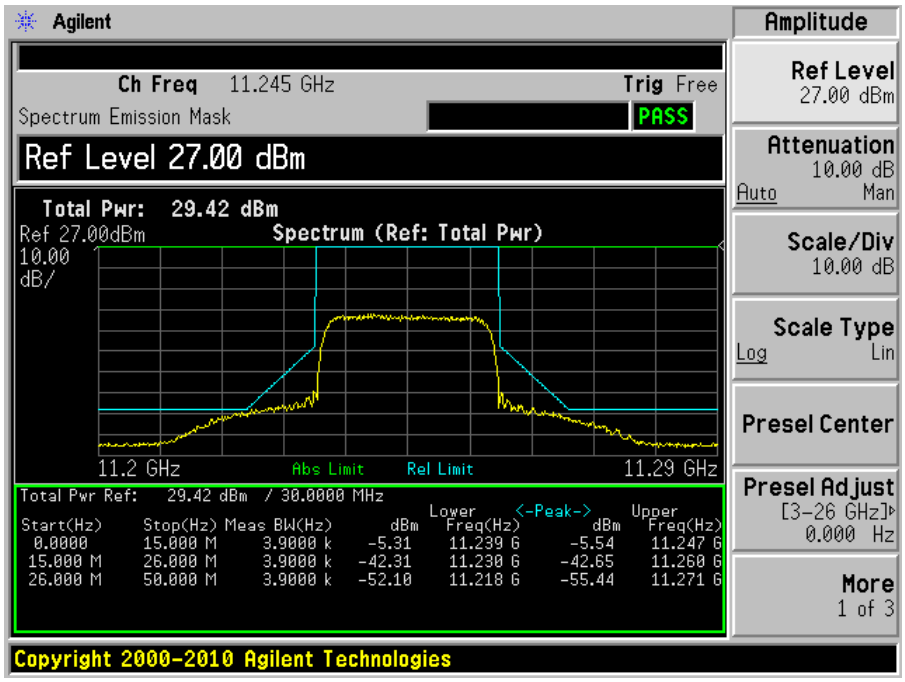
Lower Edge (-25MHz)



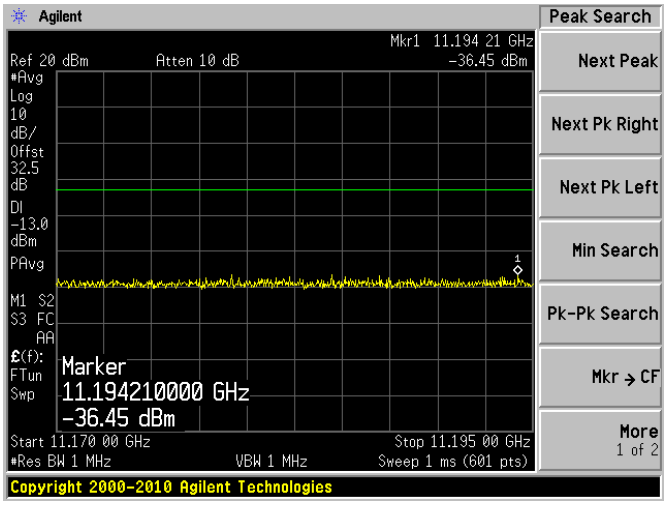
Upper Edge (+25MHz)



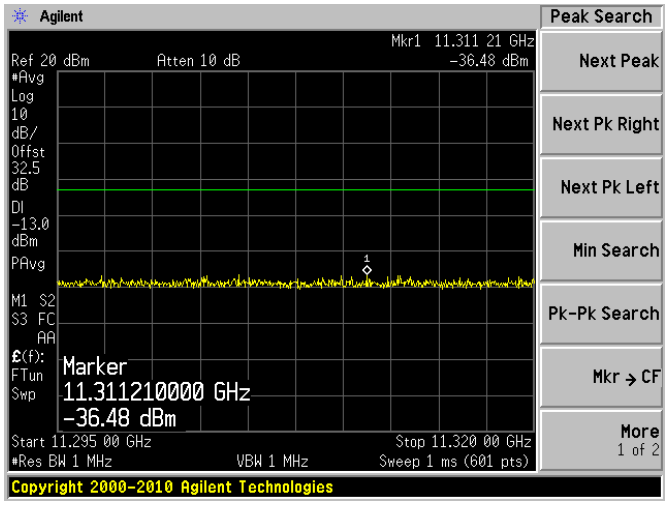
Middle Channel (11245 MHz) – 32QAM



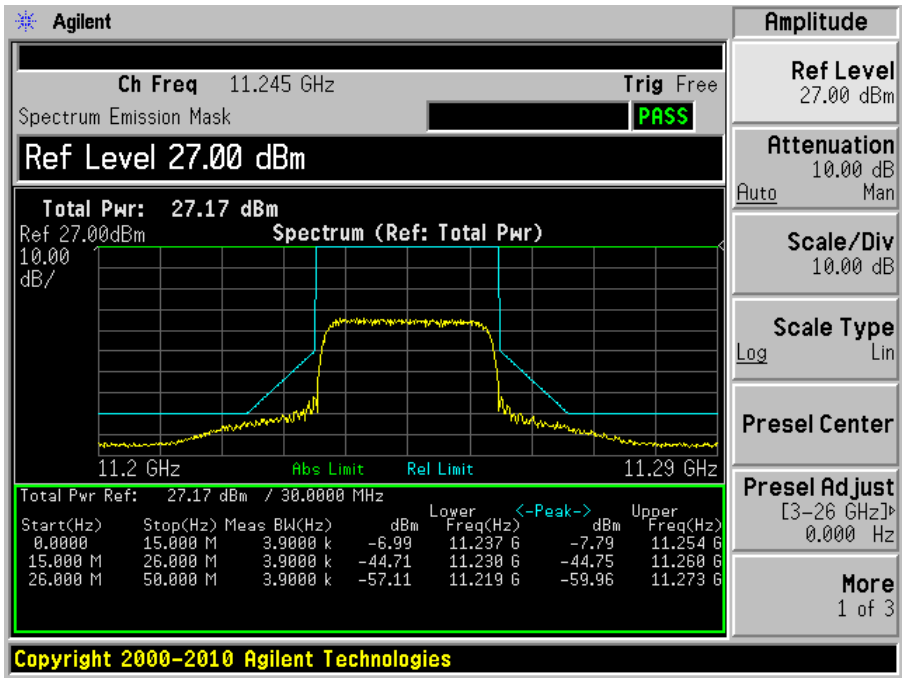
Lower Edge (-25MHz)



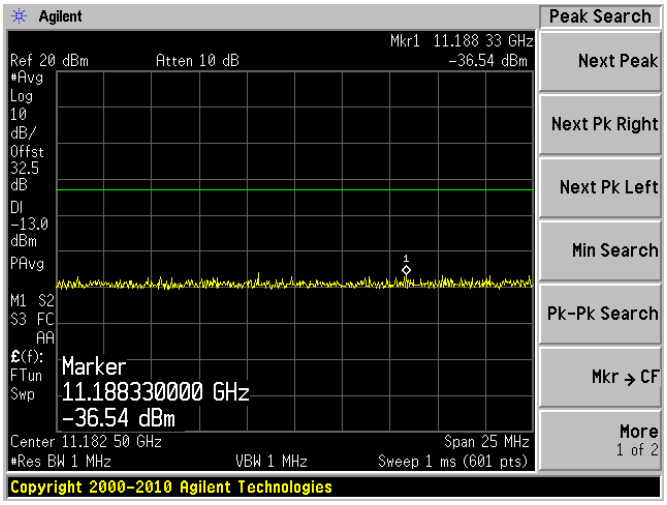
Upper Edge (+25MHz)



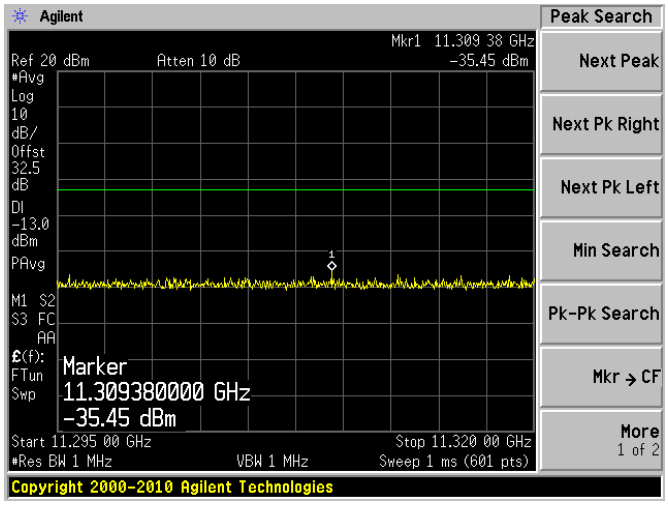
Middle Channel (11245 MHz) – 64QAM



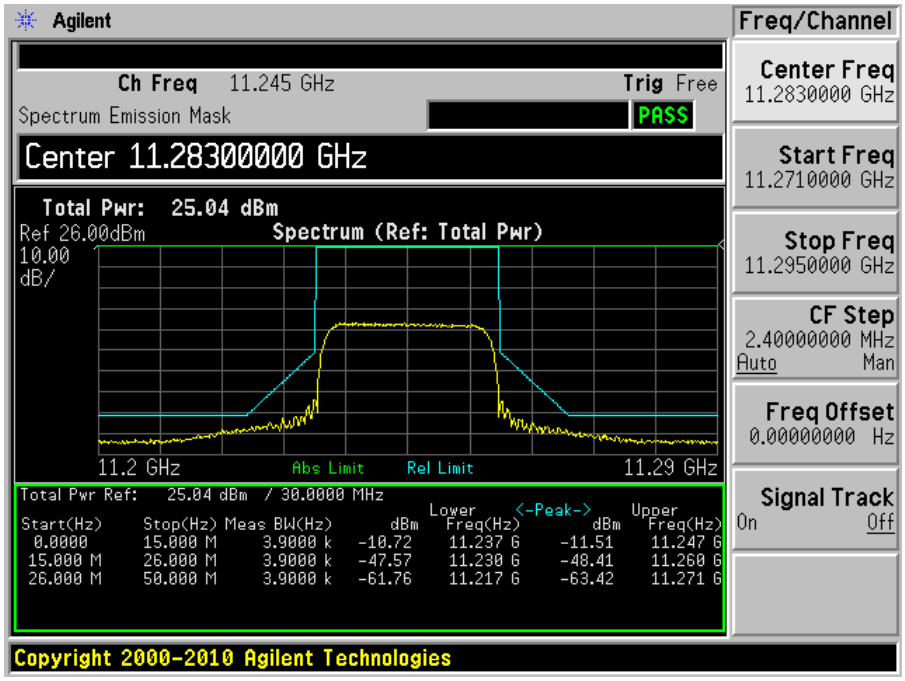
Lower Edge (-25MHz)



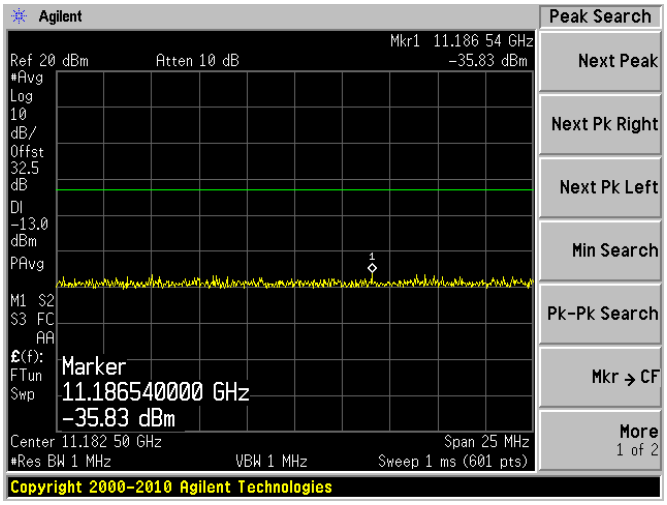
Upper Edge (+25MHz)



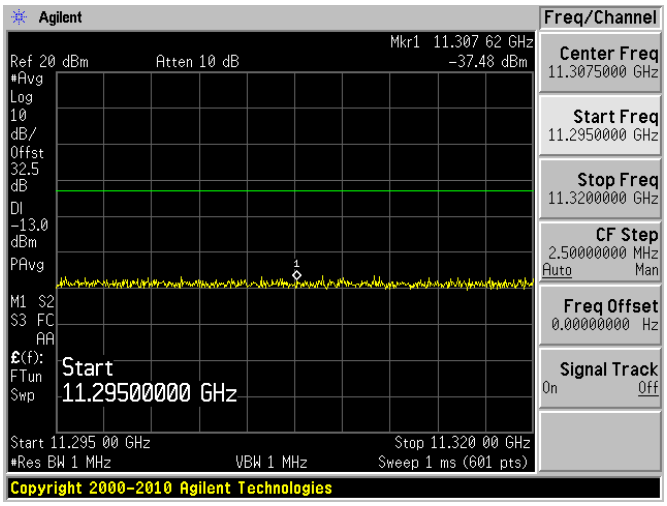
Middle Channel (11245 MHz) – 128QAM



Lower Edge (-25MHz)



Upper Edge (+25MHz)



11 Exhibit A - FCC Labeling Requirements

11.1 FCC ID Label Requirement

Per FCC Part 2.925, (a) Each equipment covered in an application for equipment authorization shall bear a nameplate or label listing the following:

(1) FCC Identifier consisting of the two elements in the exact order specified in §2.926. The FCC Identifier shall be preceded by the term FCC ID in capital letters on a single line, and shall be of a type size large enough to be legible without the aid of magnification.

Example: FCC ID: XXX123

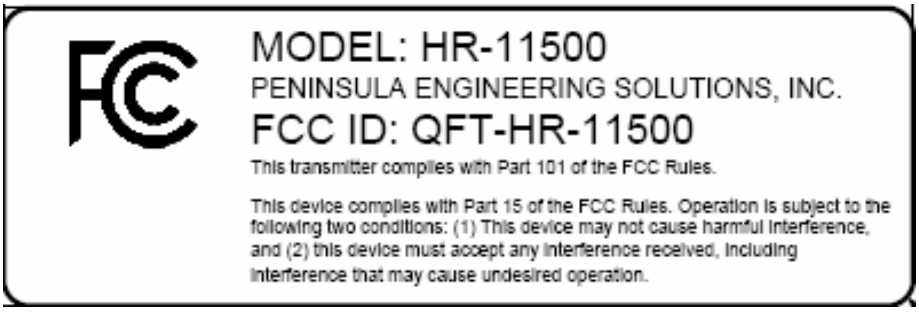
Where: XXX—Grantee Code, 123—Equipment Product Code

(b) The grantee code assigned pursuant to paragraph (c) of this section is assigned permanently to applicants/grantees and is valid only for the party specified as the applicant/grantee in the code assignment(s).

(c) A grantee code will have three characters consisting of Arabic numerals, capital letters, or combination thereof

(d) The equipment product code assigned by the grantee shall consist of a series of Arabic numerals, capital letters or a combination thereof, and may include the dash or hyphen (-). The total of Arabic numerals, capital letters and dashes or hyphens shall not exceed 14 and shall be one which has not been previously used in conjunction with:

11.2 FCC Label Contents



11.3 FCC Label Location on EUT